Conceptualization of Dry Room for Verification of Pyroprocessing Equipment

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1. Introduction

Pyroprocessing equipment uses high-temperature molten salt (LiCl, KCl) which is highly corrosive. Thus, the pyroprocessing equipment should be verified for operability in high temperature and corrosive environment. However, the existing pyroprocess facilities in Korea Atomic Energy Research Institute (PRIDE, ACPF) are designated as the radiation controlled area. Thus, those existing facilities are not suitable for performing verification experiment of various prototypes.

Therefore, to perform operability verification in high temperature and corrosive environment, construction of a dry room which is not located in radiation controlled area is required.

By the way, the dry room used in the general industry is generally operated 24 hours a day, and continuously supplies and discharges a large amount of dry air. This operation method requires a lot of electricity consumption.

Therefore, in this paper, a brand new method to decrease the operating time of the dehumidifier is suggested by using the existing dry air supplied to the facility.

2. Conceptualization of Dry Room

2.1 Requirements of dry room

The established design requirements for the dry room are shown in Table 1. In order to accommodate two pyroprocessing equipment inside the dry room, the dimension of the dry room is determined. Stainless Steel (STS) is selected to the material of inner panel, bottom plate, and ceiling to prevent corrosion during salt test.

Table 1. Design requirements for the dry room

Dry room due point	–40°C
Dry room temperature	25~30°C
Dimension (internal space)	5.2 m × 4.1 m × 4.5 m
Leak rate	< 0.01 × (dry room volume)
Material	STS (inner walls and bottom plate)
No. of people in the room	2 people

2.2 Layout of the dry room

Based on the design requirements for the dry room, layout is obtained as shown in Fig. 1.

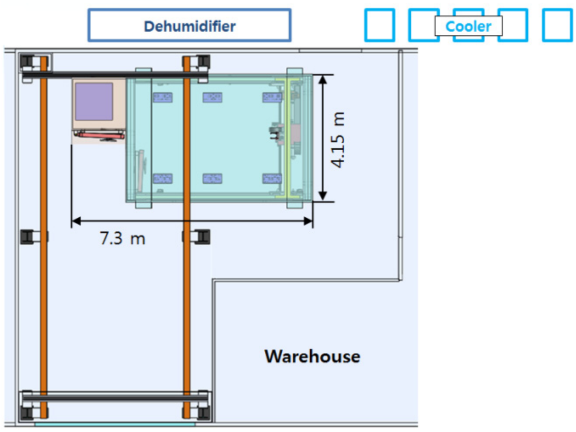

Fig. 1. Layout of the dry room.

It is planned that the dry room will be installed in the remote device experiment building in Korea Atomic Energy Research Institute. In the building, a 5 ton crane is constructed as shown in Fig. 1, and a vehicle is accessible through the south shutter door.

The dry room and preparation room will be located in indoor space, and the dehumidifier systems will be located outdoors due to lack of indoor space.

A 1 ton overhead crane will be installed in the dry room for transportation and maintenance of demonstration process equipment, and a gantry robot for remote handling and automation research will be also installed. The gantry robots has a precision of more than 1 mm will be equipped with non-contact type considering the dust and corrosive environment.

2.3 Hybrid operation strategy

As mentioned previously, the dry room is needed to perform operability verification of pyroprocessing equipment. However, general industrial dry room is used for battery manufacturing plants. These plants operate 24 hours a day, 365 days a year. Therefore, there are always workers inside the dry room, and thus, the dried air should be continuously supplied to the dry room. On the contrary, the operability verification and automation research will not be conducted frequently. Therefore, it is not economic to operate the dehumidifier system for dry room for 24 hours a day, 365 days a year.

By the way, there is a dry air supply line in the remote device experiment building. The dew point of the dry air is approximately -40 ^{o}C.

If the dry air is supplied to the dry room, the humidifier does not have to be operated when the process equipment does not operate and there is no person inside. The dehumidifier is operated when the humidity of the dry room is rapidly increased. The detailed operating procedure will be prepared in the future. By applying the brand new hybrid operating method, it is expected that the electric consumption can be significantly reduced.

3. Conclusion

The conceptualization of the dry room for mechanical demonstration of pyroprocessing equipment was performed. A few of design requirements were established and the layout of the dry room is determined. In addition, a hybrid operation method has been proposed for efficient operation. Further detailed design review and study will be conducted in the future.

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